THE BRAIN FROM BOTTOM TO TOP

The most important job of the brain is to ensure our survival, even under the most miserable conditions. Everything else is secondary. In order to do that, brains need to: (1) generate internal signals that register what our bodies need, such as food, rest, protection, sex, and shelter; (2) create a map of the world to point us where to go to satisfy those needs; (3) generate the necessary energy and actions to get us there; (4) warn us of dangers and opportunities along the way; and (5) adjust our actions based on the requirements of the moment.[4] And since we human beings are mammals, creatures that can only survive and thrive in groups, all of these imperatives require coordination and collaboration. Psychological problems occur when our internal signals don't work, when our maps don't lead us where we need to go, when we are too paralyzed to move, when our actions do not correspond to our needs, or when our relationships break down. Every brain structure that I discuss has a role to play in these essential functions, and as we will see, trauma can interfere with every one of them.

Our rational, cognitive brain is actually the youngest part of the brain and occupies only about 30 percent of the area inside our skull. The rational brain is primarily concerned with the world outside us: understanding how things and people work and figuring out how to accomplish our goals, manage our time, and sequence our actions. Beneath the rational brain lie two evolutionarily older, and to some degree separate, brains, which are in charge of everything else: the moment-by-moment registration and management of our body's physiology and the identification of comfort, safety, threat, hunger, fatigue, desire, longing, excitement, pleasure, and pain.

The brain is built from the bottom up. It develops level by level within

every child in the womb, just as it did in the course of evolution. The most primitive part, the part that is already online when we are born, is the ancient animal brain, often called the reptilian brain. It is located in the brain stem, just above the place where our spinal cord enters the skull. The reptilian brain is responsible for all the things that newborn babies can do: eat, sleep, wake, cry, breathe; feel temperature, hunger, wetness, and pain; and rid the body of toxins by urinating and defecating. The brain stem and the hypothalamus (which sits directly above it) together control the energy levels of the body. They coordinate the functioning of the heart and lungs and also the endocrine and immune systems, ensuring that these basic life-sustaining systems are maintained within the relatively stable internal balance known as homeostasis.

Breathing, eating, sleeping, pooping, and peeing are so fundamental that their significance is easily neglected when we're considering the complexities of mind and behavior. However, if your sleep is disturbed or your bowels don't work, or if you always feel hungry, or if being touched makes you want to scream (as is often the case with traumatized children and adults), the entire organism is thrown into disequilibrium. It is amazing how many psychological problems involve difficulties with sleep, appetite, touch, digestion, and arousal. Any effective treatment for trauma has to address these basic housekeeping functions of the body.

Right above the reptilian brain is the limbic system. It's also known as the mammalian brain, because all animals that live in groups and nurture their young possess one. Development of this part of the brain truly takes off after a baby is born. It is the seat of the emotions, the monitor of danger, the judge of what is pleasurable or scary, the arbiter of what is or is not important for survival purposes. It is also a central command post for coping with the challenges of living within our complex social networks.

The limbic system is shaped in response to experience, in partnership with the infant's own genetic makeup and inborn temperament. (As all parents of more than one child quickly notice, babies differ from birth in the intensity and nature of their reactions to similar events.) Whatever happens to a baby contributes to the emotional and perceptual map of the world that its developing brain creates. As my colleague Bruce Perry explains it, the brain is formed in a "use-dependent manner."[5] This is another way of describing neuroplasticity, the relatively recent discovery that neurons that "fire together, wire together." When a circuit fires repeatedly, it can become a default setting—the response most likely to occur. If you feel safe and loved, your brain becomes specialized in exploration, play, and cooperation; if you are frightened and unwanted, it specializes in managing feelings of fear and abandonment.

As infants and toddlers we learn about the world by moving, grabbing, and crawling and by discovering what happens when we cry, smile, or protest. We are constantly experimenting with our surroundings—how do our interactions change the way our bodies feel? Attend any two-year-old's birthday party and notice how little Kimberly will engage you, play with you, flirt with you, without any need for language. These early explorations shape the limbic structures devoted to emotions and memory, but these structures can also be significantly modified by later experiences: for the better by a close friendship or a beautiful first love, for example, or for the worse by a violent assault, relentless bullying, or neglect.

Taken together the reptilian brain and limbic system make up what I'll call the "emotional brain" throughout this book.[6] The emotional brain is at the heart of the central nervous system, and its key task is to look out for your welfare. If it detects danger or a special opportunity—such as a promising partner—it alerts you by releasing a squirt of hormones. The resulting visceral sensations (ranging from mild queasiness to the grip of panic in your chest) will interfere with whatever your mind is currently focused on and get you moving—physically and mentally—in a different direction. Even at their most subtle, these sensations have a huge influence on the small and large decisions we make throughout our lives: what we choose to eat, where we like to sleep and with whom, what music we prefer, whether we like to garden or sing in a choir, and whom we befriend and whom we detest.

The emotional brain's cellular organization and biochemistry are simpler than those of the neocortex, our rational brain, and it assesses incoming information in a more global way. As a result, it jumps to conclusions based on rough similarities, in contrast with the rational brain, which is organized to sort through a complex set of options. (The textbook example is leaping back in terror when you see a snake—only to realize that it's just a coiled rope.) The emotional brain initiates preprogrammed escape plans, like the fight-or-flight responses. These muscular and physiological reactions are automatic, set in motion without any thought or planning on our part, leaving our conscious, rational capacities to catch up later, often well after the threat is over.

Finally we reach the top layer of the brain, the neocortex. We share this outer layer with other mammals, but it is much thicker in us humans. In the second year of life the frontal lobes, which make up the bulk of our neocortex, begin to develop at a rapid pace. The ancient philosophers called seven years "the age of reason." For us first grade is the prelude of things to come, a life organized around frontal-lobe capacities: sitting still; keeping sphincters